2. Standard Reports

For consistency and ease of enforcement, the manner in which building features are reported by ACMs must be standardized. This section of the ACM Approval manual describes the required standard reports. All residential ACMs must automatically produce compliance reports in the Commission-prescribed format specified in the following sections of this Manual. These *Standard Reports* are required to enable building officials to evaluate the results from ACMs without having to learn each computer program. Included in every compliance package will be reports CF-1R and C-2R, which are described in detail below.

Both the CF-1R and the C-2R must have two highly visible sections, one for special features and modeling assumptions and a second for features requiring verification by approved home energy rating system (HERS) providers. These two sections serve as "punchlists" for special consideration during compliance verification by the local building department. Items listed in the *Special Features and Modeling Assumptions* section indicate the use for compliance of unusual features or assumptions, and call for special care by the local building department. Items listed in the HERS Required Verification section are for features that rely on diagnostic testing or independent verification by HERS raters under the supervision of Commission-approved HERS providers to insure proper field installation in addition to local building department inspection.

Only user inputs are described and included in the standard reports. The fixed and restricted inputs are not included since ACMs must be designed so that the fixed and restricted inputs and default values in the absence of specific user input are automatically used when the program is used for compliance.

For compliance forms, the structure of the Standard Reports described in the subsequent sections should be followed as closely as possible. The reports are divided into tabular *listings* that have a title, column headings and data entries. The data entries shown in the listings that appear in this manual are *typical* values and are included only to illustrate the report format; they are not default values and cannot be assumed to be in compliance with the standards. The specification of the category or type of data expected in each field is provided in the list of definitions associated with each column heading. The type of data entries will be one of the following:

- *text:* A variable-length text field input by the user.

- *recommended descriptor:* An abbreviation or short name from lists or tables of permissible types provided within this manual (e.g., *LgStoGas*). Only types found in these lists or tables may be used. Different descriptors may be used by the ACM as long as they are reasonable descriptors for the list entry item and are not misleading. In some cases where the descriptor is a short complete word, the descriptors are prescribed and must be used. Even for prescribed descriptors some discretion is allowed. For example, for tables with long rows *Y* may be used for the prescribed descriptor *Yes*. User-defined descriptors may NOT be used but rather must be

automatically assigned by the ACM based upon user input. For example, *UWALL01* may be assigned by the ACM to the first user-defined wall type.

- *filename.ext*: The name of the input or output file
- dimensions or units of measure, such as "hr-ft^2-/F /Btu", ft^2, etc.
- *Num:* A cardinal or ordinal number.

Modifications will be approved by the Commission when they are necessary because of conceptual differences between ACMs or because of special modeling features. The categories of information represented in the tables and the standard headings must not be changed. Additional columns or additional tables may be added when necessary and column headings may be abbreviated, and reports may be reformatted with different character spacing, line spacing, row heights or column widths to permit better readability or paper conservation. ACMs may also provide additional customized information at the bottom of the standard reports, separated from the standard report by a line.

Some of the tables in the Standard Reports are not applicable for all buildings. When a table is not applicable for a particular building, it should be omitted. When one of the standard tables is included, all the columns should be included (although column width may be reduced), even if some of the information in the columns is not applicable to the proposed design.

The Standard Reports are designed to accommodate the optional modeling capabilities included in this manual. Approval of additional optional modeling capabilities may require modification of the standard report format.

2.1 Certificate of Compliance (CF-1R)

The Certificate of Compliance (report CF-1R) is the first standard report that must be produced. The Certificate of Compliance is required by the Administrative Requirements (Title 24, Section 10).

Heading. The following heading shall appear on the first page.

CERTIFICATE OF COMPLIANCE: RESIDENTIAL		Page 1 of 2 CF-1R
Project Title	Filename:	Date:
Project Address	Run Title:	<runcode>
Documentation Author		<initiation time>
Telephone		Building Permit #
Compliance Method		Plan Check / Date
Location/Climate Zone		Field Check/ Date

The Filename , Run Title, Runcode, and Initiation Time need not appear in the header as shown above but must appear as part of the header information for all pages of the Certificate of Compliance.

Subsequent pages shall have the following heading.

CERTIFICATE OF COMPLIANCE: RESIDENTIAL		Page 2 of 2 CF-1R
Project Title	Filename:	Date:
	Run Title:	<runcode/initiation time>

- *Project Title, Date, Project Address, Documentation Author and Telephone, and Climate Zone (text):* Display user inputs for these fields.
- *Filename (filename.ext):* The filename of the input file used to generate the compliance form.
- *Compliance Method (text):* The Alternative Calculation Method program name and version number (e.g., CALRES2 v2.01)
- *<Runcode/Initiation Time> (alphanumeric text):* A unique runcode designation generated automatically by the ACM to identify the specific run. This number and the initiation time changes with each run initiated by the user even though the filename and Run Title may remain the same. The initiation time is the time (including the hour and minute) that the compliance run was initiated by the user.
- *Run Title (text):* Optional user input item. Use for commentary or description of unique characteristics of a particular run.

General Information. This listing in the Certificate of Compliance follows the first page heading on both the CF-1R and the CF2-R and provides basic information about the building. The items and information listed on the Certificate of Compliance are identical to some of the items and information found in the Computer Method Summary (C-2R). A description of these data elements is given later in this chapter.

GENERAL INFORMATION

Conditioned Floor Area:	1384 ft^2
Average Ceiling Height	10.2 ft.
Building Type:	Single Family Detached
Building Front Orientation:	15 deg (North)
Glazing Area as % of Floor Area	14.4%
Average Fenestration U-Value	0.52
Average Fenestration SHGC	0.60
Number of Stories	2
Number of Dwelling Units:	1
Floor Construction Type:	Raised Floor

Building Insulation. This listing summarizes the insulation levels and conditions for the opaque surfaces of the building and slab perimeters. A separate row is to be provided for each unique condition. If a radiant barrier is used for a roof, the ACM is required to report this feature. The ACM may either add a column, titled "Radiant Barrier" and place the word "Yes" in the corresponding row, or the words "Radiant Barrier" are to be automatically placed in the Location/Comments field in the row associated with the roof surface having the radiant barrier."

Metal-framed walls are reported in the frame type column. The use of metal-framed walls must be reported in the *Special Features and Modeling Assumptions* listing since metal framing reduces the effective R-value of cavity insulation by short circuiting heat flow.

BUILDING INSULATION

Component Type	Frame Type	Cavity Insulation R-value	Sheathing Insul. R-value	Total R-value	Assembly U-value	Location/Comments
Wall	Wd2x4@16”oc	R-11	R-4	15.38	0.065	typical
Wall	Mtl2x4@16”oc	R-13	R-7	12.20	0.082	at garage
Mass Wall	n/a	R-5	R-0	6.29	0.159	Foundation
Roof	Wd2x6@24”oc	R-38	R-0	38.5	0.026	Attic w/Radiant Barrier
Roof	Wd2x10@24”oc	R-30	R-0	29.41	0.034	Vaulted Ceiling
Door	n/a	R-0	R-0	3.03	0.33	
Floor	Wd2x12@24”oc	R-19	R-0	27.03	0.037	crawl space
Floor	Wd2x10@16”oc	R-19	R-0	20.83	0.048	over garage
Slab Perimeter	n/a	R-7	n/a			F2 = 0.76 uninsulated

- *Component Type.* Possible types are wall, mass wall, door, ceiling or roof, floor over crawl space, exposed floor, slab perimeter, etc.

- *Frame Type.* Framing information shall include framing material [wood (*Wd*) or metal (*Mtl*) alternatively steel (*Stl*) or aluminum (*Alu*)], the nominal size of framing members [e.g. 2x4 for nominal 2" x 4"], and their nominal spacing [@16"oc for "at 16 inches on center"]. Metal framing is presumed to be steel framing unless otherwise coded.

- Cavity *Insul R-value.* The R-value of the cavity insulation alone, not including framing effects, dry wall, air films, etc. If no insulation is proposed, the response may be "none".

- *Total R-value.* The number one divided by the *Assembly U-Value* (the inverse of the *Assembly U-Value* or $1/U_{assembly}$) rounded to two digits to the right of the decimal point.

- *Sheathing Insul. R-value:* The sum total R-value of continuous insulation layers which are not penetrated by framing members. These are for layers used specifically for insulation (R-2 or greater) and do not include interior or exterior finish materials such as drywall or exterior siding layers unless they have significant thermal resistance. For slabs-on-grade, report the R-value of slab edge insulation.

- *Assembly U-value.* The U-value for the assembly, including framing effects. Calculated U-values are rounded to three digits to the right of the decimal point. (U-values are calculated using standard engineering principles as documented in the Glossary, Appendix G of the *Residential Manual*[1] under *R-Value*)

- *Location/Comments.* A verbal description of where the component is located or other relevant information.

Floors. This listing summarizes floor types and surface areas. The ACM shall use this information to determine the thermal mass for the Standard Design and the default thermal mass for the Proposed Design. This listing must include all conditioned floor area and may include listings of unconditioned floor types and areas.

FLOOR TYPES AND AREAS

Construction Type	Area (ft^2)	Conditioned?	Location/Description
Slab	1086	Yes	1st Floor
Slab	226	No	Garage
NonSlab	675	Yes	2nd Floor

- *Construction Type:* The construction type of the floor. Construction type is either *Slab or NonSlab Floor.* A *Slab* floor includes slab-on-grade floors and raised slab floors with conditioned space above and unconditioned space below. Raised slab floors with conditioned space above and below are considered *NonSlab* floors for this categorization. Floors with unconditioned space above may be either *Slab* or *NonSlab*.

[1] 1998 Residential Manual, California Energy Commission Publication P400-98-002.

- *Area (ft^2).* The area of the mass element in square feet.
- *Conditioned?*: The conditioning status of the air immediately above the floor. *Yes* indicates that the air is conditioned and *No* indicates that the air above this part of the floor is unconditioned. An ACM may exclude this column if it is clear to the user that all entries for floor area are for conditioned floor area only. If the ACM excludes this output column, the ACM must assign all user entered floor areas as conditioned floor areas and spaces with unconditioned floor areas such as sunspaces shall not be modeled.
- *Location/Description.* A verbal description of the location of the floor.

Fenestration Surfaces. The term "fenestration" is used to refer to an assembly of components consisting of frame and glass or glazing materials. According to the standards, fenestration includes "any transparent or translucent material plus frame, mullions, and dividers, in the envelope of a building." Fenestration surfaces include windows, skylights and glazing in doors or other transparent or translucent surfaces. This listing reports information about each fenestration surface. One row is to be included in the listing for each unique fenestration condition. When compliance is for all orientations, the building facade orientations shall be reported for the case with the "front" facing north or the orientation shall be reported as "*Any*", and the *Special Features and Modeling Assumptions* listings must also indicate that compliance is for all orientations.

FENESTRATION SURFACES

Fenestration #/Type/Orien	Orien-tation	Area (ft^2)	Fenes.tration U-value	Fenestration SHGC	Interior Shading Att.	Exterior Shading Att.	Over-hang /Fins
1 Wdw Front	N	10	0.65	0.70			None
2 Wdw Front	NW	40	0.65	0.60	Roller-shade		None
3 Wdw Front	N	8	1.23	1.23	Blindsna	na	None
4 Wdw Left	W	110	0.65	0.65		Shade-screen	None
5 Wdw Back	S	50	0.65	0.65			Ovhg
6 Wdw Back	S	8	1.23	1.23			None
7 Wdw Right	E	85	0.65	0.65			None
8 Sky Back	S	8	1.23	1.23			None
9 Sky Horz	na	22	1.23	1.23			None

- *Fenestration Surface: Num/Type/Loc (#/text/prescribed descriptor).* *Num* is a unique number assigned by the user to each fenestration item in the fenestration surfaces list (see Computer Method Summary; C-2R). The type is Wdw (window) Dr (door) or Sky (skylight). *Loc* is the location of the surface with respect to the front of the building (Front, Back, Left, Right or na).
- *Orientation* (prescribed descriptor) is reported here as the nearest 22.5° compass point in parenthesis (N, NNE, NE, ENE etc.). *Orientation* may also be reported to the nearest degree (0°-360°) When compliance is for all orientations, orientation may

be listed as *All* or only the *Loc* need be reported or *Orientation* may be reported with Front facing North.

- *Area (ft^2).* The rough frame area of the fenestration in square feet.
- *U-value*. The rated U-value of the fenestration product, in Btu/h-ft^2-°F, including air films. Calculated fenestration U-values are rounded and reported to 2 digits to the right of the decimal.
- *Fenestration SHGC:* The Solar Heat Gain Coefficient (SHGC) for this fenestration system typically the glazing plus the frame. This value corresponds to the rated value reported on a Commission-approved label, a Commission default value reported on a manufacturer's label, or a Commission default value for a carpenter's window.
- *Interior Shading Att.:* A verbal description of the interior shading attachment if an attachment other than the default drapery is proposed. Interior shades recognized by the standards include default draperies, blinds (all colors and styles), and opaque roller shades. Translucent roller shades have higher SHGCs than opaque roller shades hence they are modeled as default draperies. The Solar Heat Gain Coefficients (SHGCs) for these attachments shall be taken from the attachments listed in Table 2-1 below.

The allowed solar heat gain coefficient of the attachments shown in Table 2-1 are based on the shading performance of those products in combination with 1/8" single pane clear glass and metal framing. "*Standard*" (Default Interior Shade - Draperies) or " " (a blank field) must automatically appear in this field when no special interior shading device is included in the building plans.

Table 2-1 Allowed Interior Shading Devices and Recommended Descriptors

Recommended Descriptor	Interior Shading Attachment Reference	Solar Heat Gain Coefficient before 1/1/2002	Solar Heat Gain Coefficient after 1/1/2002
Standard	Draperies or No Special Interior Shading - Default Interior Shade	0.68	0.68 [1]
Blind	Venetian Blind, Vertical Blind or MiniBlind	0.47	0.47
OpRollShd	Opaque Roller Shades	0.47	0.68
None [2]	No Interior Shading - Only for Skylights (Fenestration tilt <60 degrees)	1.00	1.00

Note (general): No other interior shading devices or attachments are given credit for compliance with the building efficiency standards.

Note 1: Default drapery shading shall be assumed whenever no other interior shading is specified for a window. Output shall note that although *Standard* is specified, a drapery is modeled but is not required to

be installed and present at final inspection . Output shall note for any interior shading device other than drapery that it must be installed and present at final inspection.

Note 2: *None* is the default for fenestration tilted less than 60 degrees from horizontal (skylights) and is only allowed for fenestration tilted less than 60 degrees from horizontal (skylights)., i.e. *None* is not an interior shading option for ordinary vertical windows.

- *Exterior Shading Att.:* A verbal description of the exterior shading attachment, when applicable. Only a limited number of shading attachments may be used for shading credit in the performance approach. The exterior shading attachments and their allowed SHGCs are listed in Table 2-2 below:

- "Standard" (Default Bug Screen) or " " must automatically appear when no special exterior shading device is included in the building plans. The standard design assumes that Standard or default partial bugscreen coverage credit is used for all windows. The proposed design assumes that Standard is used for all windows unless other exterior shading attachments are specified. Standard credit has been reduced to account for the fact that bugscreens will only cover a portion of all windows in a house or residence. A user claiming credit for any ordinary bugscreens must use Standard as the input for the exterior shading device modeled.

Table 2-2 Allowed Exterior Shading Devices and Recommended Descriptors

Recommended Descriptor	Exterior Shading Device Reference	Solar Heat Gain Coefficient
Standard	Bugscreens or No Shading - Default Bug Screens are modeled.	0.76
WvnScrn	Woven SunScreen (SC<0.35)	0.30
LvrScrn	Louvered Sunscreen	0.27
LSASnScrn	LSA Sunscreen	0.13
RlDwnAwng	Roll-down Awning	0.13
RlDwnBlnds	Roll -down Blinds or Slats	0.13
None [1]	For skylights only - No exterior shading	1.00

Note 1: *None* is the default for fenestration tilted less than 60 degrees from horizontal (skylights) and is only allowed for fenestration tilted less than 60 degrees from horizontal (skylights)., i.e. *None* is not an exterior shading option for ordinary vertical windows.

- *Overhangs/Fins:* An indication of whether or not the fenestration is shaded by overhangs or fins [*Ovhg, Fins, Both, None]*

Thermal Mass. This listing summarizes thermal mass elements in the proposed design. Note that ACMs must require the input of conditioned slab floor area and the conditioned

nonslab floor area prior to the entry of special thermal mass features. These two areas determine the thermal mass for the Standard Design and the default thermal mass for the Proposed Design. The specific thermal mass for the proposed design is ONLY modeled if the thermal mass for the proposed design exceeds a specific threshold, otherwise the default thermal mass is modeled for both the Proposed and Standard Designs (See Sections 3.6 and 3.7 for more details). This *Thermal Mass* listing **must not** be reported unless the Proposed Design's thermal mass exceeds the mass credit threshold. When the thermal mass in the *Proposed Design* is greater than the threshold mass it must be reported in this format and it **must automatically** be reported in the *Special Features and Modeling Assumptions* listing and independently verified by the local enforcement agency.

THERMAL MASS

Type/Covering	Area (ft^2)	Thickness	Location/Description
Slab Exposed	120	3.5 in	Kitchen entry
Slab Covered	250	3.5 in	Kitchen dining
Nonslab	980	0	All Other
Tile	34	0.5 in	Bath

- *Type/Covering.* The type of mass and the surface condition (exposed or covered). The types described in the *Residential Manual* Glossary may be used.
- *Area (ft^2).* The area of the mass element in square feet.
- *Thickness.* The mass thickness in inches.
- *Location/Description.* A verbal description of the location of the mass or other special features.

Infiltration/Ventilation. This listing is only produced when the applicant has used reduced infiltration measures or mechanical ventilation measures to improve the overall energy efficiency of the Proposed Design while maintaining adequate air quality. The use of reduced infiltration requires diagnostic blowerdoor testing by a certified HERS rater to verify the modeled reduced leakage area and to ensure minimum infiltration/ventilation rates are achieved. Relevant information regarding infiltration and ventilation must be reported in the *HERS Required Verification* listings on the CF-1R and the C-2R. The listings must indicate that diagnostic blower door testing must be performed as specified in ASTM E 779-87 (Reapproved 1992) , *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*. This listings must also report the target $CFM50_H$ required for the blowerdoor test to achieve the modeled SLA and the minimum $CFM50_H$ (corresponding to an SLA of 1.5) allowed to avoid backdraft problems. This minimum allowed value is considered by the Commission to be "unusually tight" per the requirements of the Uniform Mechanical Code.

When the target $CFM50_H$ of the *Proposed Design* is below the value corresponding to an SLA of 3.0, mechanical ventilation with a minimum capacity of 0.047 CFM per square foot of conditioned floor area is required. This requirement for mechanical ventilation and

minimum capacity must be reported in the *HERS Required Verification* and the *Special Features and Modeling Assumptions* listings of the CF-1R and C-2R. Also, the *HERS Required Verification* listings must state that when the measured $CFM50_H$ is less than the minimum allowed value, corrective action must be taken to either intentionally increase the infiltration or provide for mechanical supply ventilation adequate to maintain the residence at a pressure greater than -5 pascals relative to the outside average air pressure with other continuous ventilation fans operating.Mechanical ventilation may also be used in conjunction with reduced infiltration to achieve even greater energy savings. When mechanical ventilation is part of the Proposed Design the exhaust and supply fan wattages must be reported in this listing and the *HERS Required Verification* listings. Whenever mechanical ventilation is modeled by the user or required by modeling an SLA of 3.0 or less, the mechanical ventilation capacity selected by the user must be greater than or equal to 0.047 cfm per square foot of conditioned floor area to be modeled by an approved ACM. If the user enters a volumetric capacity that is less than 0.047 cfm/ft^2, the ACM must indicate an input error to the user and block compliance output.

When reduced infiltration or mechanical ventilation is modeled, the *Special Features and Modeling Assumptions* listings must include a statement that the homeowner's manual provided by the builder to the homeowner must include instructions that describe how to use the operable windows or mechanical ventilation to provide for proper ventilation.

INFILTRATION/VENTILATION DETAILS *(Example Listing)*

Blower Door Leakage Target ($CFM50_H$/SLA)	Blower Door Leakage Minimum ($CFM50_H$/SLA)	Vent. Fan CFM (Supply/Exhaust)	Mechanical Vent Fans (Watts) [Supply/Exhaust]
1250/2.9	586/1.5	200/300	*50/75*

- *Blower Door Leakage Target ($CFM50_H$ /SLA):* The measured blower door leakage in cfm at 50 pascals of pressurization and its equivalent Specific Leakage Area (SLA) value.
- *Blower Door Leakage Minimum ($CFM50_H$ /SLA):* The backdraft limit for the blower door leakage test which corresponds to a Specific Leakage Area (SLA) of 1.5 which is considered to be "unusually tight" and must satisfy the Uniform Mechanical Code requirements for "unusually tight" construction. The ACM must report in the *HERS Required Verification* listings that the Commission considers this minimum CFM and the corresponding SLA of 1.5 or less to be "unusually tight" per the Uniform Mechanical Code. In the sample listing given above a 1600 square foot house and the SLA lower limit of 1.5 is used to get the *Blower Door Leakage Minimum* shown.
- *Vent. (Ventilation) Fans (CFM):[Supply/Exhaust]* The total volumetric capacity of supply fans and exhaust fans listed separately, separated by a slash (or reported in separate columns). The balanced portion of mechanical ventilation is the smaller of these two numbers while the unbalanced portion is the difference between these two numbers. These values are reported in cubic feet per minute.

- *Mechanical Vent. (Ventilation) Fans (Watts) [Supply/Exhaust]:* The total power consumption of the supply ventilation fans and the total power consumption of the exhaust ventilation fans in watts.

HVAC Systems. This listing provides data on the heating and cooling systems in the building. These data are identical to those in the Computer Method Summary (Report C-2R) under "HVAC Systems" described on Page 38

HVAC SYSTEMS

System Name	System Type	Minimum Equipment Efficiency	Distribution Type and Location	Duct R-value
Zone=Living				
LowerHeat	GasFurnace	0.78 AFUE	DuctsCrawl	4.2
LowerAC	AirCond-Split	10.0 SEER	DuctsCrawl	4.2
Zone=Sleep				
UpperHeat	Electric	1.00 COP	Baseboard	
UpperAC	AirCond-Split	10.0 SEER	DuctsAttic	4.2

- *System Name (text):* A unique name for the HVAC system
- *System Equipment (recommended descriptor):* The type of HVAC equipment. This is specified separately from the distribution type.

  Permissible equipment types: Listed in Tables 2-3 and 2.4.

  In the case of *CombHydro* heating, the name of the water heating system should be identified in the previous column. When the proposed house is not air conditioned, the entry should be *NoCooling*. If more than one type of equipment is specified, each must be listed on separate rows.

Table 2-3 HVAC Heating Equipment Descriptors

Recommended Descriptor	Heating Equipment Reference
CntrlFurnace	Gas- or oil-fired central furnaces or heating equipment considered equivalent to a gas-fired central furnace, such as wood stoves that qualify for the wood heat exceptional method. Gas fan-type central furnaces have a minimum AFUE=78%. Distribution can be gravity flow or use any of the ducted systems. [Efficiency Metric: AFUE]
Heater	Non-central gas- or oil-fired space heaters, such as wall heaters floor heaters or unit heater. Equipment has varying efficiency requirements. Distribution is ductless and may be gravity flow or fan-forced.[Efficiency Metric: AFUE]
Boiler	Gas or oil boilers. Distribution systems can be *Radiant*, *Baseboard* or any of the ducted systems. *Boiler* may be specified for dedicated hydronic systems. Systems in which the boiler provides space heating and fires an indirect gas water heater (*IndGas*) may be listed as *Boiler/CombHydro Boiler* and must be listed under "Equipment Type" in the HVAC Systems listing. [Efficiency Metric: AFUE]
SplitHeatPump	Heating side of central split system heat pump heating systems. Distribution system must be one of the ducted systems. [Efficiency Metric: HSPF]
PkgHeatPump	Heating side of central packaged heat pump systems. Central packaged heat pumps are heat pumps in which the blower, coils and compressor are contained in a single package, powered by single phase electric current, air cooled, rated below 65,000 Btuh. Distribution system must be one of the ducted systems. [Efficiency Metric: HSPF]
LrgPkgHeatPump	Heating side of large packaged units rated at or above 65,000 Btu/hr (heating mode). Distribution system must be one of the ducted systems These include water source and ground source heat pumps. [Efficiency Metric: COP]
RoomHeatPump	Heating side of non-central room air conditioning systems. These include small ductless split system heat pump units and packaged terminal (commonly called "through-the-wall") units. Distribution system must be *DuctIndoor*. [Efficiency Metric: COP]
Electric	All electric heating systems other than space conditioning heat pumps. Included are electric resistance heaters, electric boilers and storage water heat pumps (air-water) (StoHP). Distribution system can be *Radiant*, *Baseboard* or any of the ducted systems. [Efficiency Metric: HSPF]
CombHydro	Water heating system can be storage gas (*StoGas*, *LgStoGas*), storage electric (*StoElec*) or heat pump water heaters (*StoHP*). Distribution systems can be *Radiant*, *Baseboard*, or any of the ducted systems and can be used with any of the terminal units (*FanCoil*, *RadiantFlr*, *Baseboard*, and *FanConv*).

Table 2-4 HVAC Cooling Equipment Descriptors

Recommended Descriptor	Cooling Equipment Reference
NoCooling	Entered when the proposed building is not air conditioned or when cooling is optional (to be installed at some future date). Both the *Standard Design* equivalent building and the proposed design use the same default system (refer to sections 3 and 4). [Efficiency Metric: SEER]
SplitAirCond	Split air conditioning systems. Distribution system must be one of the ducted systems. [Efficiency Metric: SEER]
PkgAirCond	Central packaged air conditioning systems less than 65,000 Btuh cooling capacity. Distribution system must be one of the ducted systems. [Efficiency Metric: SEER]
LrgPkgAirCond	Large packaged air conditioning systems rated at or above 65,000 Btu/hr (cooling capacity). Distribution system must be one of the ducted systems. [Efficiency Metric: EER]
RoomAirCond	Non-central room air conditioning cooling systems. These include small ductless split-system air conditioning units and packaged terminal (commonly called "through-the-wall") air conditioning units. Distribution system must be *DuctIndoor*. [Efficiency Metric: EER]
SplitHeatPump	Cooling side of split heat pump systems. Distribution system must be one of the ducted systems. [Efficiency Metric: SEER<65,000 Btu/hr EER>65,000 Btu/hr]
PkgHeatPump	Cooling side of central single-packaged heat pump systems with a cooling capacity less than 65,000 Btuh. Distribution system must be one of the ducted systems. [Efficiency Metric: SEER]
LrgPkgHeatPump	Cooling side of large packaged heat pump systems rated at or above 65,000 Btu/hr (cooling capacity). Distribution system must be one of the ducted systems. [Efficiency Metric: EER]
RoomHeatPump	Cooling side of non-central, room heat pump systems. These include small ductless split-system air conditioning units and packaged terminal (commonly called "through-the-wall") units. Distribution system must be *DuctIndoor*. [Efficiency Metric: EER]
EvapDirect	Direct evaporative cooling systems. The SEER is set to 11.0. The default distribution system location is *DuctAttic*; evaporative cooler duct insulation requirements are the same as those for air conditioner ducts. [Efficiency Metric: SEER]
EvapIndirDirect	Indirect-direct evaporative cooling systems. The SEER is set to 13.0. The default distribution system location is *DuctAttic*; evaporative cooler duct insulation requirements are the same as those for air conditioner ducts. [Efficiency Metric: SEER]

- *Minimum Equipment Efficiency/Method (fraction/recommended descriptor):* The minimum equipment efficiency needed for compliance along with the applicable method.

  Permissible Methods: *AFUE* for furnaces and boilers, *HSPF* for electric heating equipment, *SEER* for heat pumps (cooling) and central air conditioners, and *RE* for water heaters.

  If equipment type is *Electric*, an HSPF of 3.413 should be entered, except for radiant systems which may use an HSPF of 3.55.

- *Distribution Type and Location (recommended descriptor):*

  Permissible entries: Listed in Table 2-5

Table 2-5 HVAC Distribution Type and Location Descriptors

Recommended Descriptors	HVAC Distribution Type and Location Reference
Ducted Systems	Fan-powered, ducted distribution systems that can be used with most heating or cooling systems. When ducted systems are used with furnaces, boilers, or combined hydronic/water heating systems the electricity used by the fan shall be calculated using the methods described later in this manual. R-value must be specified in "Duct R-value" column when a ducted system is specified
DuctsAttic	Ducts located overhead in the unconditioned attic space
DuctsCrawl	Ducts located underfloor in the unconditioned crawl space
DuctsGarage	Ducts located in an unconditioned garage space.
DuctsBasemtl	Ducts located in an unconditioned basement space
DuctsInEx12	Ducts located within the conditioned floor space except for less than 12 lineal feet of duct, typically an HVAC unit in the garage mounted on return box with all other ducts in conditioned space.
DuctsInAll	HVAC unit or systems with all HVAC ducts located within the conditioned floor space, such as gas-fired wall furnaces. This category is used also for systems such as wall furnaces having a fan.
DuctsOutdoor	Ducts located in exposed locations outdoors.
Ductless Systems	Ductless radiant or warm/cold air systems using fan-forced or natural air convection and hydronic systems relying upon circulation pumps and fan-forced or natural air convection, and
Furnaces	Heating equipment such as wall and floor furnaces
Radiant	Radiant electric panels or fanless systems used with a boiler, electric or heat pump water heater, or combined hydronic heating equipment.
Baseboard	Electric baseboards or hydronic baseboard finned-tube natural convection systems

- *Diagnostic Duct Leakage.* If diagnostic duct leakage is specified by the user, the requirement for diagnostic testing shall be reported in the *HERS Required Verification* listings on the CF-1R and C-2R.
- *Duct R-value(hr-ft^2-/F/Btu).* The installed R-value for duct insulation. The minimum value is 4.2, which is required by the mandatory measures section.

  When the modeled duct R-value is larger than 4.2, the ACM must report the modeled R-value in this listing and must specify this higher duct R-value in the *Special Features and Modeling Assumptions* listings.

  The modeled R-value cannot be less than 4.2 °F-ft^2-hr/Btu unless an existing building and an existing HVAC distribution system is being modeled as part of an

existing plus addition analysis. When duct R-value is less than 4.2 the *Special Features and Modeling Assumptions* listings must indicate that an existing building with an existing HVAC distribution system is being modeled as part of an existing plus addition analysis.

HVAC Distribution Systems Misc. This listing details important information associated with the use of special HVAC distribution efficiency The use of any of these features is considered to be special and must also be individually listed on the *HERS Required Verification* listing and individually verified.

HVAC DISTRIBUTION EFFICIENCY DETAILS *(Example Listing)*

System Name	Measured Duct Leakage Target (% of fan cfm / leakage cfm)[1,2]	Measured Duct Surface Area (ft^2)	ACCA Manual D Design	Fan CFM
Primary	6%/75.6	*150*	*Yes*	1200
Bath	n/a	*None*	*No*	*n/a*

Note 1: % of fan cfm is used when the HVAC system is installed at the time of testing and is based on a supply fan capacity of 400 cfm per ton of air conditioning capacity or 21.7 cfm per 1,000 Btus/hour of furnace capacity. When the HVAC is not installed or its capacity is not known the alternate leakage target reported is calculated from 6% of 0.70 cfm per square foot of conditioned floor area for Climate Zones 8 to 15 and 0.50 cfm per square foot of conditioned floor area for the remaining Climate Zones. For an 1800 square foot house in Climate Zone 13 (example shown above) the maximum duct leakage when system capacity is unknown is 75.6 cfm at 25 pascals.

Note 2: The HERS Required Verification listings must include the information specified in Note 1 or the results of those calculations as the method of reporting the appropriate target values for the reduced duct leakage test.

- *System Name (text):* Descriptive name corresponding to a system name defined in the HVAC System listing.
- *Measured Duct Leakage Target (% of fan cfm/leakage cfm):* Reduced duct leakage has been modeled to determine seasonal duct efficiency. This credit requires site diagnostic testing by a certified HERS rater supervised by a Commission-approved HERS provider tested in accordance with the procedures in Appendix F. The test results must be less than 6% of fan cfm (derived from installed system capacity when present or from the default assumptions for duct efficiency calculations when the HVAC heating or cooling equipment is not installed) and reported by the HERS rater on a CF-6R form and verified by the local enforcement agency. The target duct leakage must be listed in the *HERS Required Verification* section.
- *ACCA Manual D Design (prescribed descriptor: Yes* or *No)*: Indicates whether modeling credit for ACCA Manual D duct design has been used. When duct

efficiency credit for ACCA Manual D design is claimed, the *HERS Required Verification and the Special Features and Modeling Assumptions* listings must specify that the ACCA Manual D design, layout, and calculations be submitted to the local enforcement agency and a certified HERS rater. The certified HERS rater shall verify the existence of ACCA Manual D layout and calculations and verify that the field installation is consistent with this design.

- *Measured Duct Surface Area (ft2)*: This item is applicable only if the entry for *ACCA Manual D Design* is "*Yes*" and documents the modeling of reduced duct surface area when a value other than na (not applicable) is reported. The *HERS Required* Verification listing must indicate that this total value and its subcomponent areas by location must be verified by a certified HERS rater. Moreover reduced duct sizes must still preserve adequate air flow to receive duct efficiency credit. Consequently credit for reduced duct surface area also requires that the HERS rater measure and report HVAC supply fan flow to verify that the manufacturer's specified fan flow, consistent with the ACCA manual D design, has not been impaired by reduced duct sizes. The *HERS Required Verification* listing must also indicate this requirement.

  When *Measured Duct Surface Area* is specified the *HERS Verification Listings* must report the supply duct surface area in each of four locations: *Attic/Outside, Crawlspace, Basement, Garage.* This listing must also report whether or not the basement where the ducts are located is conditioned or not.

Water Heating Systems. This listing provides information on the water heating systems used in the building and is identical to information in the listings of the Computer Method Summary (C-2R) described on Page 42. Information concerning auxiliary energy systems, the performance and features of instantaneous gas, large storage gas and indirect gas water heaters, and combined hydronic equipment, if installed, must be included in the *Special Features and Modeling Assumptions listing* if energy credit is taken for such systems. When combined hydronic systems, solar water heating, or wood stove boilers are used, ACM's must augment the Water Heating Systems listing with the inclusion of two additional listings, Water Heating Systems Misc and Water Heater/Boiler Details, The use of these optional capability features must be reported in the *Special Features and Modeling Assumptions* listing with cross references to the Water Heating Systems Misc and Water Heater/Boiler Details listings, and the content of these listings verified as *Special Features*.

WATER HEATING SYSTEMS

System Name	Distribution Type	Water Heater Name	Water Heater Type	Number of Heaters (#)	Energy Factor	Tank Volume (gal)
Upper Floors	Recirc/Timer	State100	StorGas	3	.52	100
Lower Floors	Recirc/Timer	State50	StorGas	4	.62	50
Kitchens	POU	Loch006	InstElec	18	.98	na.

- *System Name (text):* Unique descriptive name for the water heating system. The name must be linked to entries in the Water Heating Systems Misc and Water Heater System Assignments listings.
- *Distribution Type (recommended descriptor):* The type of distribution system used to transport hot water from the water heater to the point of use. Qualifying requirements for these distribution systems are included in Section 6.6 of the *Residential Manual*.

  Permissible types: Listed in Table 2-7

Table 2-6 Water Heating Distribution System Descriptors

Recommended Descriptor	Distribution System Reference
Std	Standard (non-recirculating) potable water heating system with tank storage remote from points of consumptive use
POU	Point-of-use potable water heating system, within 8' of fixtures
HWR (optional)	Standard system with hot water recovery capability
Std/PIns	Standard system with pipe insulation entire length of piping run
ParallelPiping	Individual pipes from the water heater to each point of use
Recirc	Recirculation system, continuous operation w/o control
Recirc/Timer	Recirculation system, timer controlled
Recirc/Dmd	Recirculation system, demand controlled
Recirc/Temp	Recirculation system, temperature controlled
Recirc/Timer/Temp	Recirculation system, timer + temperature controlled
R/D&HWR	combination *Recirc/Dmd + HWR*
R/D&PIns	combination *Recirc/Dmd + PIns*

- *Water Heater Name (text):* User-defined descriptive name that is specified in the Water Heater Systems and Water Heater/Boiler Details listings.

- *Water Heater Type (recommended descriptor)*: The type or category of water heater used. Permissible types: Listed in Table 2-8

Table 2-7 Water Heater Type Descriptors

Recommended Descriptor	Water Heater Reference
StoGas	gas[2]- or oil-fired storage tank ≥ 2 gal, input ≤ 75,000 Btu/hr
LgStoGas	gas- or oil-fired storage tank, input > 75,000 Btu/hr
StoElec	electric-resistance-heated storage tank ≥ 2 gal
InstGas	instantaneous gas-fired, storage < 2 gal
InstElec	instantaneous electric-resistance-heated, storage < 2 gal
StoHP	electric heat pump with storage tank
IndGas	storage tank indirectly heated by gas- or oil-fired source
Boiler	boiler dedicated solely to hydronic space heating

- *Num of Heaters (#)*:The quantity of water heaters of this type in the system.
- *Energy Factor (fraction)*: Applicable to all water heater types subject to National Appliance Energy Conservation Act (NAECA) regulations. Does not apply to *LgStoGas* types; for these types enter "na". If the energy factor is not published, then the water heater is not covered by NAECA and the Water Heater/Boiler Details listing must be completed.
- *Tank volume (gal)*: The listed storage volume of the water heater.

Note: When water heaters with an Energy Factor (EF) of less than 0.58 are installed, the *Special Features and Modeling Assumptions* must list the EF of the water heater and the R-value of externally-applied insulation wrap in hr-ft^2-/F/Btu as well as the mandatory R-value requirement for external insulation for these water heaters.

Water Heating Systems Misc. This listing details credits associated with the use of solar water heating, wood stove boilers and provides information about combined hydronic pump energy for electric combined hydronic systems. A credit may be taken for either a solar water heating system or a wood stove boiler, but not both.

[2]Gas may be natural gas or propane.

WATER HEATING SYSTEMS MISC *(Example Listing)*

System Name	Solar Savings Fraction	Solar System Type	Wood Stove Boiler?	Wood Stove Boiler Pump?	Combined Hydronic Pump Power (Watts)
Hydronic	0.00	*None*	*Yes*	*Yes*	60.00
DHW	0.64	*Passive*	*No*	*No*	

- *System Name (text):* Descriptive name corresponding to a system name defined in the Water Heating Systems listing.
- *Solar Savings Fraction (fraction):* Fraction of the annual heating load for the system met by solar energy, if the water heating system uses a solar system to provide auxiliary heating. The Solar Savings Fraction may be determined using *f-Chart* or other methods approved by the Commission.
- *Solar System Type (prescribed descriptor)*: Defines the general type of solar system.

  Permissible types: *Active* (pump/blower assisted solar collection/circulation), *Passive* (natural collection/circulation), and *None*
- *Wood-Stove Boiler (prescribed descriptor)*: Indicates whether a wood-stove boiler is used.

  Permissible entries: *Yes* and *No.*
- *Wood-Stove Boiler Pump (prescribed descriptor)*: Indicates whether a wood-stove boiler pump is used to circulate water between the wood stove and the storage tank.

  Permissible entries: *Yes* and *No.*
- *Combined Hydronic Pump (Watts):* Required only for electric combined hydronic *(Elec/, StoElec/ and InstElec/CombHydro*) systems. Not required for storage gas/oil or heat pump combined hydronic systems (*StoGas/, LgStoGas/, and StoHP/CombHydro*).

Water Heater/Boiler Details. This listing provides information about the energy characteristics of the water heaters or boilers used in combined hydronic (*CombHydro*) systems and for non-NAECA water heaters; it will not be applicable to the remainder. In such cases, "na" may be reported.

WATER HEATER/BOILER DETAILS *(Example Listing)*

Water Heater Name	Recovery Efficiency (fraction)	AFUE (fraction)	Rated Input (kBtu/hr)	Standby Loss (fraction)	Tank R-value (hr-ft^2-/F/Btu)	Pilot Energy (Btu/hr)
CombHydState 100	0.78	na	60.00	na	na	na
BigRmWH	0.79	na	75.00	0.04	15.30	na

- *Water Heater Name (text):* Name of water heater specified in the Water Heating Systems listing. In the case of a hydronic system heater, the name should be descriptive of this function to distinguish it from any domestic water system heaters.
- *Recovery Efficiency (fraction):* Recovery efficiency is the performance measure for instantaneous gas water heaters (*InstGas*), large storage gas/oil water heaters (*LgStoGas*) and indirect gas/oil water heaters (*IndGas*). It is also required for storage gas/oil water heaters (*StoGas*) used in combined hydronic systems (*CombHydro*). The value is taken from the Commission's appliance databases[3] or from the manufacturer's literature. If the value is omitted for NAECA regulated water heaters, then the default value will be assumed. When boilers are used to fire an indirect gas/oil water heater (*IndGas*), the value of the AFUE (see below) is used for the recovery efficiency.
- *AFUE (fraction):* Annual Fuel Utilization Efficiency, the heating efficiency of the water heater based upon approved test methodologies. Values of AFUE are listed in the Commission's directories cited above.
- *Rated Input (kBtu/hr):* The energy input rating from the above directories or from the manufacturer's literature. Entries are required for large storage gas/oil water heaters *(LgStoGas)*, indirect gas/oil water heaters (*IndGas*), and when storage gas water heaters (*StoGas/LgStoGas*) or heat pump water heaters (*StoHP*) are used in combined hydronic space heating systems (*CombHydro*).

[3] The complete appliance databases can be downloaded from the Energy Commission's Internet FTP site (ftp://sna.com/pub/users/eff-tech/appliances). This requires database software (spreadsheet programs cannot handle some of the larger files). To use the data, a user must download the database file (or files), download a brand file and a manufacturer file and then decompress these files. Then download a description file that provides details on what is contained in each of the data fields. With these files, and using database software, the data can be sorted and manipulated. Directories approved by the Commission may also be used. Currently the Commission has approved the Gas Appliance Manufacturers Association (GAMA) *Consumers' Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment* directory to be used to verify certification on *some* residential appliances. The GAMA directory (Sections I and II) can be used for gas furnaces, boilers and water heaters.

- *Standby Loss (fraction):* The fractional storage tank energy loss per hour during non-recovery periods (standby) taken from the Commission's directories cited above. Applicable only to large storage gas water heaters (*LgStoGas*).
- *Tank R-value (hr-ft^2-/F/Btu):* The total thermal resistance of the internally-insulated tank and any external insulation wrap. Applicable to large storage gas/oil (*LgStoGas*) and indirect gas/oil (*IndGas*) water heaters only.
- *Pilot light (Btu/hr)*: The pilot light energy consumption rating from one of the Commission's directories, cited above. Applicable only to instantaneous gas (*InstGas*) and indirect gas/oil (*IndGas*) water heaters.

Special Features and Modeling Assumptions. This listing must **stand out and command the attention** of anyone reviewing this form to emphasize the importance of verifying these Special Features and the aspects of these features that were modeled to achieve compliance or the energy use results reported. This listing in the Certificate of Compliance must include any special features of the building that affect the building's compliance with the standards and which are not described elsewhere on the Certificate of Compliance. For example, water heating features, or auxiliary credits must be listed under "*Special Features and Modeling Assumptions*" as well as being listed under a special listing of their own. The use of certain non-default values must also be included in this list. These special default values are indicated in the subsequent text. This listing should also include any variations in building features necessary to achieve compliance in multiple orientations.

SPECIAL FEATURES AND MODELING ASSUMPTIONS: (*Example Listing)*	Plan	Field
This house has Zonal control with multiple zones, interzone surfaces, and interzone ventilation.		
This building uses metal-framed walls that must meet mandatory insulation requirements. In this case R-7 sheathing has been used in addition to the R-13 cavity insulation. for these walls.		
This house has an attached sunspace with interzone surfaces ,custom solar heat gain distribution and sunspace thermal mass elements		
This house is modeled with reduced infiltration and/or mechanical ventilation. Consequently the homeowner's manual provided by the builder to the homeowner must include operating instructions for the homeowner on how to use operable windows and/or mechanical ventilation to achieve adequate ventilation.		

HERS Required Verification. Specific features that require diagnostic testing to assure proper installation require field testing and verification by a certified home energy rater (HERS rater) under the supervision of a CEC- approved HERS provider, and must be listed in this section. This listing must **stand out and command the attention** of anyone reviewing this form to emphasize the importance of HERS verification of these features and the aspects of these features that were modeled to achieve compliance. or the energy use results reported.

All items in the *HERS Required Verification* listings must also report that the installer and HERS rater must both provide the appropriate CF-6R documentation for proper installation, testing, and test results for the features that require verification by a HERS

rater. The installer must document and sign the CF-6R to verify compliance with design and installation specifications. The HERS rater must document and sign the CF-6R to confirm the use of proper testing procedures and protocol, to report test results, and to report field verification of installation consistent with the design specifications needed to achieve these special compliance efficiency credits.

The ACM must ask the user if there are vented combustion appliances inside the conditioned space that draw air for combustion from the conditioned space prior to any entry for reduced infiltration or mechanical ventilation. Cooking appliances, refrigerators and domestic clothes dryers are excluded from this requirement. If appliances other than cooking appliances, refrigerators and domestic clothes dryers are present and use conditioned air for combustion, the ACM must instruct the user that reduced infiltration must not be modeled when these devices are part of the Proposed Design and block data entries and ACM modeling of reduced infiltration and mechanical ventilation. When the user indicates that such devices are present or when the user models reduced infiltration or mechanical ventilation, the ACM must report in the *Special Features and Modeling Assumptions* listings that reduced infiltration and/or mechanical ventilation are prohibited from being modeled when vented combustion appliances, not excluded above, are inside conditioned space.

When a *Proposed Design* is modeled with a reduced target infiltration ($CFM50_H$) that corresponds to an SLA less than 3.0, mechanical ventilation is required and must be reported in the *HERS Required Verification* listings.

HERS REQUIRED VERIFICATIONS : (*Example Listing)*	Plan	Field
This house is using reduced duct leakage to comply and must have diagnostic site testing of duct leakage performed by a certified HERS rater under the supervision of a CEC-approved HERS provider. The results of the diagnostic testing must be reported on a CF-6R form and list the target and measured CFM duct leakage at 25 pascals.		
This house has tight construction with reduced infiltration and a target blower door test range between 586 and 1250 CFM at 50 pascals. The blower door test must be performed using the ASTM *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*, ASTM E 779-87 (Reapproved 1992).		
WARNING: If this house tests below 586 CFM at 50 pascals, the house must either be provided with a ventilation opening that will increase the tested infiltration to at least 586 CFM at 50 pascals (SLA = 1.5) OR mechanical supply ventilation must be provided that can maintain the house at a pressure of at least -5 pascals relative the outside average air pressure while other continuous ventilation fans are operating. Note also that the Commission considers an SLA≤1.5 to be "unusually tight" per the Uniform Mechanical Code.		
WARNING - Houses modeled with reduced infiltration are prohibited from having vented combustion appliances other than cooking appliances, refrigerators and domestic clothes dryers that use indoor air for combustion inside conditioned space.		

Compliance Statement and Signatures. Signature requirements and other details on the compliance statement are included in Section 1.3 of the *Residential Manual*.

COMPLIANCE STATEMENT

This certificate of compliance lists the building features and performance specifications needed to comply with the Energy Standards in Title 24, Parts 1 and 6, of the California Code of Regulations, and the Administrative regulations to implement them. This certificate has been signed by the individual with overall design responsibility. When this certificate of compliance is submitted for a single building plan to be built in multiple orientations, any shading feature that is varied is indicated in the *Special Features and Modeling Assumptions* section.

Designer or Owner (per Business & Professions Code)		**Documentation Author**	
Name	_____	Name	_____
Title/Firm	_____	Title/Firm	_____
Address	_____	Address	_____
City & Zip Code	_____	City & Zip Code	_____
Telephone	_____	Telephone	_____
License Number	_____	Signature/Date	_____
Signature/Date	_____		
Enforcement Agency			
Name	_____		
Title	_____		
Agency	_____		
City	_____		
Telephone	_____		
Signature/Date	_____		

2.2 Computer Method Summary (C-2R)

The second standard report, that must be automatically produced, gives more detail about the program inputs. The Computer Method Summary must always accompany the Certificate of Compliance when the computer performance approach is used.

The Computer Method Summary shall include all information provided by the program user.

Information on the Computer Method Summary is provided below to illustrate the use of all the standard tables.

Report Heading. The following heading shall appear on the first page of each Computer Method Summary.

COMPUTER METHOD SUMMARY		Page 1 of 4 C-2R
Project Title	Filename:	Date:
Project Address		<runcode>
Documentation Author		<initiation time>
Telephone		Building Permit #
Compliance Method		Plan Check / Date
Climate Zone		Field Check/ Date

The following heading shall appear on subsequent pages.

COMPUTER METHOD SUMMARY		Page 2 of 4 C-2R
Project Title	Filename:	Date:
	<runcode/initiation time>	

Energy Use Summary. This section compares the energy use of the proposed building to the energy budget of the standard design building. All units in this table are source kBtu/ft^2-year. Energy is shown for space heating, space cooling and hot water. The space heating and cooling energy budgets are determined from the standard design using the custom budget method. The water heating budget is calculated from the water heating budget equation contained in the standards. ACM vendors may add additional columns to this report when appropriate, such as for multi-zone building analyses.

ENERGY USE SUMMARY (kBtu/ft^2-yr)

	Standard Design Energy Budget	Proposed Design Energy Use
Space Heating	23.45	21.23
Space Cooling	10.34	8.23
Water Heating	15.90	14.67
Total	49.69	44.13

Additional rows may be added to the table when necessary to accommodate energy uses that are to be included in the analysis but cannot be easily assigned to one of the three principal categories. For example, an additional row for miscellaneous electrical energy may be required if electric equipment energy use cannot be assigned separately to heating, cooling or hot water.

General Information. This section contains general information about the project.

GENERAL INFORMATION

Conditioned Floor Area:	1384 ft^2
Building Type:	Single-family detached
Building Front Orientation:	0 deg (North)
Number of Dwelling Units:	1
Number of Stories:	1
Floor Construction Type:	Slab on grade
Number of Conditioned Zones:	2
Total Conditioned Volume:	11072 cf
Conditioned Slab Floor Area:	1384 ft^2
Total Conditioned Floor Area:	1384 ft^2

- *Conditioned Floor Area.* The conditioned floor area of all building zones modeled in the computer run.
- *Building Type.* The type of building. Possible types are single-family detached, single-family attached (which includes duplexes and halfplexes) multi-family (all other attached dwellings including condominiums), addition alone, addition plus existing, or alteration.
- *Building Front Orientation.* The azimuth of the front of the building. This will generally be the side of the building where the front door is located. A typical reported value would be "290° (west)". This would indicate that the front of the building faces north 70° west in surveyors terms. The closest orientation on 45° compass points should be verbally reported in parenthesis, e.g. north, northeast, east, southeast, south, southwest, west or northwest. When compliance is shown for multiple orientations, "all orientations" may be reported. When "all orientations" is

reported, the *Special Features and Modeling Assumptions* listing shall describe shading features that vary with orientation.

- *Number of Dwelling Units.* The total number of dwelling units in the building. This number may be a fraction for cases of addition alone.
- *Number of Stories*. The number of building stories as defined by the *Uniform Building Code*.
- *Floor Construction Type.* The floor construction type determines the basis of the custom budget or the standard design building; choices are slab or nonslab. Rules for determining the type of floor construction are discussed in Chapter 3 of this Manual.
- *Number of Conditioned Zones.* The number of conditioned zones modeled in the computer run.
- *Total Conditioned Volume.* The total volume of conditioned space within the building.
- *Conditioned Slab Floor Area.* The total area of slab floor (on grade or raised) with conditioned space above and the ground or unconditioned space below This is used to determine the standard design mass requirement for buildings and the default values of the thermal mass requirements for the proposed design.
- Total Conditioned *Floor Area.* The total floor area of conditioned space in the building to be permitted. This area must be no less than the *Conditioned Slab Floor Area* specified above. The conditioned nonslab floor area is the difference between the *Total Conditioned Floor Area* and the *Conditioned Slab Floor Area* and is used to determine the thermal mass for the Standard Design, the default value of thermal mass for the Standard Design, and the threshold thermal mass requirement for thermal mass credit in the Proposed Design. The conditioned nonslab floor area includes any nonslab floors, raised or not, and raised slab floors with conditioned space above and below the floor.

Building Zone Information. For most compliance documentation, only one row will be reported in this table. Additional rows are reported when a proposed building is modeled as two zones (zonal control), or when attached, unconditioned spaces are modeled, such as crawl spaces or sunspaces.

BUILDING ZONE INFORMATION

Zone Name	Floor Area (ft^2)	Volume (ft^3)	# of Units	Zone Type	Tstat Type	Vent Height (ft)	Vent Area (ft^2)
House	1384	11072	1	Conditioned	Setback	2.0	32

- *Zone Name.* Each zone is given a name that is used to categorize information in the following tables.

- *Floor Area (ft^2).* The floor area of the zone measured to outside wall. The sum of the floor area of all conditioned zones must equal the conditioned floor area reported under "General Information".
- *Volume (ft^3).* The volume of the zone. The sum of the volume of all conditioned zones must equal the total volume reported under "General Information".
- *# of Units.* The number of dwelling units in the zone. This number may be a fraction for cases of addition alone or a building in which there are more zones than dwellings.
- *Zone Type.* This description controls some modeling restrictions, such as infiltration, internal and solar gains, etc. Possible conditioned zone entries are Conditioned, Living and Sleeping. Possible unconditioned zone entries include Unconditioned, CVCrawl and Sunspace.
- *Thermostat Type.* Possible conditioned zone entries are Setback, NoSetback, LivingStat, SleepingStat. Additional thermostat types may be allowed for optional modeling capabilities.
- *Vent Height (ft).* The height difference between the "inlet" ventilation area and the "outlet" ventilation area. The default ventilation height is determined by the number of stories: one story - 2 feet, two or more stories - 8 feet. Different vent heights may be modeled but a non-default vent height is considered a special feature or special modeling assumption that must be reported in the *Special Features and Modeling Assumptions* listing for special verification. The ventilation height for other windows is the average height difference between the centers of the lower operable window openings and the centers of the upper operable window openings.
- *Vent Area (ft^2).* This entry is either the default vent area which is assumed by the ACM based on entries in the Fenestration Surfaces table or some other value entered by the user. A Vent Area value greater than 10% of the total rough-out opening area (all windows treated as opening type: “slider”) of all fenestration must be reported in the *Special Features and Modeling Assumptions* listing for special verification.

Opaque Surfaces. A row shall be reported in this table for each unique opaque surface in the proposed building. Opaque surfaces include walls, roofs, floors and doors.

For buildings that are modeled as multiple thermal zones, the opaque surfaces shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

OPAQUE SURFACES

Surface Type	Area (ft^2)	U-Value	Cavity Insul R-value	Sheath. Insul. R-value	Total R-value	True Azimuth	Tilt	Solar Gains	Form 3 Reference	Location/ Comments
Zone=Living										
Wall	105.4	0.088	R-13	na	11.30	0	90	Yes	Wall-1	Typical
Wall	145.4	0.068	R-11	R-4	14.69	180	90	Yes	Wall-1	Typical
Base WallA	100	0.124	na	R-6	8.08	0	90	No	BWall-1	0-2 ft below grade
Base Wall B	160	0.124	na	R-6	8.08	0	90	No	BWall-2	2-6 ft. below grade
Wall	176.8	0.088	R-13	na	11.30	270	90	Yes	Wall-1	Typical
Roof	692	0.031	R-30	na	32.48	0	0	Yes	Roof-1	Typical
Door	40	0.330	na	na	3.03	0	90	Yes	Door-1	Typical
Zone=Sleep										
Wall	145.4	0.088	R-13	na	11.30	0	90	Yes	Wall-1	Typical
Wall	176.8	0.068	R-11	R-4	14.69	90	90	Yes	Wall-1	Typical
Wall	145.4	0.088	R-13	na	11.30	180	90	Yes	Wall-1	Typical
Roof	692	0.031	R-30	na	32.48	0	0	Yes	Roof-1	Typical
Zone=SunSpc										
Wall	72	0.088	R-13	na	11.30	90	90	Yes	Wall-1	Sunspace Wall
Wall	90	0.088	R-13	na	11.30	180	90	Yes	Wall-1	Sunspace Wall
Wall	72	0.088	R-13	na	11.30	270	90	Yes	Wall-1	Sunspace Wall
Roof	135	0.031	R-30	na	32.48	0	0	Yes	Roof-1	Sunspace Roof

- *Surface Type.* Valid types are Wall, BaseWallA (0-1.99 ft below grade), BaseWallB (2.0-5.99 ft below grade) , BaseWallC (more than 6 ft below grade), Roof/Ceiling, and Floor. If floor is over a crawl space (FlrCrawl), then the U-values used in the custom budget run are based on having a crawl space. Otherwise, they are not. Floor types and areas are also used to determine the default thermal mass for the Proposed Design and the thermal mass for the Standard Design.
- *Area (ft^2).* The area of the surface.
- *Assembly U-value.* The overall U-value of the surface assembly. (U-values are calculated using standard engineering principles as documented in the *Residential Manual*[4], Appendix G and Appendix H.
- *Cavity Insul R-val.* The rated R-value of the installed insulation in the cavity between framing members. This does not include framing effects or the R-value of drywall, air films, etc. When insulating sheathing is installed over a framed wall, the "Cavity Insul R-val" should report the insulation in the cavity only.

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4 *1998 Residential Manual,* California Energy Commission Publication P400-98-002.

- *Sheath Insul R-val.* The sum total rated R-value of all installed layers of insulating sheathing (R-2 or greater). Multiple sheathing layers must report the total of the sum of the R-values for all insulating sheathing layers. Gypsum board and exterior siding layers are not included unless they have an R-value greater than 2.0. Cavity insulation is not reported. The R-values of air films are not included

- *Total R-value.* The total R-value of the opaque surface assembly. This includes framing effects and the R-value of drywall, air films, etc. For below grade walls this value does not include the outside air film nor the R-value of the adjacent soil or gravel. For raised floors over a crawlspace, this value does not include the R-value for the crawlspace.

- *True Azimuth.* The actual azimuth of the surface after adjustments for building rotation. There are various ways of describing the orientation or azimuth of surfaces. For ACMs approved by the CEC, a standard convention must be used. The azimuth is zero degrees for surfaces that face exactly north. From this reference the azimuth is measured in a clockwise direction. East is 90 degrees, south 180 degrees and west 270 degrees.

- *Tilt.* The tilt of the surface. Vertical walls are 90°; flat roofs are 0°; floors are 180°.

- *Solar Gains.* A yes/no response is given to indicate if a surface receives solar gains. Surfaces that do not receive solar gains may include floors over crawl spaces and walls adjacent to garages. Only a yes/no response is required since the surface absorptance is a fixed input.

- *Form 3 Reference.* A reference to attached Form 3's that may accompany the compliance documentation. This name may also be referenced from the thermal mass table to indicate an exterior mass wall.

- *Location/Comments.* User provided text describing where the surface is located or other relevant information.

Perimeter Losses. This table provides details about components of the building envelope that are modeled as perimeter losses. Typical perimeter losses are slab edge losses, retaining wall losses, and losses from the base of controlled ventilation crawl spaces. A row is provided in the table for each unique perimeter element. Note that a single F2 factor is reported for slab edge losses for slab floor interiors that are carpeted or exposed based on a fixed assumption of 20% of the edge adjacent to exposed slab. This assumption must be used and separate F2 values for different interior covering conditions may not be reported or modeled by an approved ACM.

For buildings that are modeled as multiple thermal zones, the items shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

PERIMETER LOSSES

Perimeter Type	Length (ft)	F2 Factor	Insul R-val	Insul Depth (in)	Location/Comments
Zone=Living					
SlabEdge	76	0.75	R-3	8	Exposed edge
Zone=Sleep					
SlabEdge	76	0.75	R-3	8	Exposed edge
Zone=SunSpc					
SlabEdge	65	0.90	R-0	na	Exposed edge

- *Perimeter Type.* The perimeter type. Possible types are slab edge, crawl space perimeter, etc. Names may be abbreviated.
- *Length (ft).* The perimeter length in feet.
- *F2 Factor.* The perimeter heat loss factor (see Section 4.22).
- *Insul R-Val.* The R-value of the installed insulation. "R-0" or "None" should be reported when no insulation is installed.
- *Insul Depth (in).* The depth that the insulation extends below the top surface of the slab in inches.
- *Location/Comments.* User provided information on the location of the perimeter element or other relevant information.

Fenestration Surfaces. This listing must include information about each fenestration surface in the proposed building. Fenestration surfaces include windows, skylights and glazing in doors or other transparent or translucent surfaces. One row is included in the listing for each unique fenestration condition. This listing must also report a note that the SHGC values for fenestration must be taken from an approved label or from the default table in the standards. Default table values for SHGC can only be used when the ACM automatically selects the default based upon other user inputs for the fenestration. ACMs must restrict users to select from a limited list of interior and exterior shading devices and their associated solar heat gain coefficients (SHGCs), namely, those devices and SHGCs listed in Table 2-1 for interior shading devices and those devices and SHGCs in Table 2-2 for exterior shading devices. ACMs shall not allow users to enter custom shading devices nor account for differences in alternative color, density, or light transmission characteristics. Translucent roller shades must be treated as drapes. ACM's are required to calculate, but not report, $SHGC_{open}$ and $SHGC_{closed}$ using 1998 Standards calculation procedures and assumptions.

For buildings that are modeled as multiple thermal zones, the fenestration surfaces shall be grouped for each zone and indicated with a header "Zone = <Zone Name>". The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

FENESTRATION SURFACES

Fenestration #/Type/Orien	Area (ft^2)	U-Value	Fenes. SHGC	True Az	Tilt	Exterior Shade Type /SHGC	Interior Shade Type/SHGC
Zone=Living							
1 Wdw Front(N)	70.4	0.65	0.88	0	90		Blinds/ 0.47
2 Wdw Left(E)	70.4	0.65	0.88	90	90	WveScrn/ 0.39	StdDrp/ 0.68
Zone=Sleeping							
3 Wdw Back(S)	70.4	0.65	0.88	180	90		RllrShd/ 0.47
4 Wdw Right(W)	70.4	0.65	0.88	270	90	LvrScrn/ 0.36	StdDrp/ 0.68

- *Fenestration #/Type/Orien.* The # is a unique number for each different fenestration surface entry. The type is Wdw (window) Dr (door) or Sky (skylight). The *Orien* (orientation) is the side of the building (front, left, right or back) followed by the nearest 45° compass point in parenthesis (N, NE, etc.). When compliance is for all orientations, only the side of the building may be reported (front, right, etc.)

- *Area (ft^2).* The area of the surface in square feet. This should generally be the rough frame opening.

- *U-value.* The rated U-value of the fenestration product, in Btu/h-ft^2-°F.

- *True Azimuth.* The true (or actual) azimuth of the glazed surface after adjustment for building rotation. The convention for describing the azimuth is standardized as discussed above under opaque surfaces.

- *Tilt.* The tilt of the glazed surface. Most windows will have a 90° tilt. Skylights typically have a tilt equal to the corresponding roof surface.

- *Fenestration SHGC :* The solar heat gain coefficient of the fenestration.

- *Exterior Shade Type/SHGC.* The type of exterior shading device and its solar heat gain coefficient from Table 2-2. "*Standard/0.76"* or " " must appear when no special exterior shading device is included in the building plans. *Standard (partial bugscreen)* shading shall automatically be given for all window area without other forms of exterior shading devices. This shading assumes that a portion of the window area is covered by bugscreens. Other valid exterior shades include louvered screens (*LvrScrn*), woven sunscreen (*WvnScrn*), and Low Sun Angle Sunscreen (*LSASnScrn*). When used for compliance purposes, ACMs shall not allow or accept input for user-defined exterior shades.

- *Interior Shade Type/SHGC.* The type of interior shading device and its solar heat gain coefficient from Table 2-1. "*Standard/0.68*" or " ", (no special interior shading or any drapery) must appear when no other interior shading device is included in the building plans and specifications. Output shall indicate that the default devices - in this case draperies - are not required to be installed even if *Standard* appears on an output list. Note that this default category now covers all types of draperies including all colors and weave densities. Two other types of interior shading devices may be

specified: *Blinds* and *RollrShd* (opaque roller shades). **Translucent roller shades** are classified as **default draperies** (*Standard*). No other interior shading devices or attachments are recognized or given credit in the standards.

Solar Gain Targeting. This table is only used for special cases, such as sunspaces (an optional modeling capability, and hence a Special Feature). Solar gains that enter conditioned spaces must be targeted to the air, but when glazing surfaces enclose unconditioned spaces, such as sunspaces, the user is allowed to target all but 25% of the solar gains from these surfaces to mass elements located within the unconditioned space. More than one row of targeting data may be included for each glazed surface. Unassigned solar gain is targeted to the air in the unconditioned space. At least 25% of the solar gain from any sunspace fenestration surface must be targeted to high surface area lightweight mass or the air. At most 60% of the solar gain may be targeted to the slab floor of a sunspace, especially in the summer. An ACM must automatically enforce these limits and inform the user of any attempt to exceed these limits.

Note that the use of any optional capability such as sunspace modeling must be reported in the *Special Features and Modeling Assumptions* listings. In addition, solar gain targeting must be separately reported in the *Special Features and Modeling Assumptions* listings so that the local enforcement agency can verify that these inputs are reasonable.

SOLAR GAIN TARGETING

Fenestration #/Type/Orien	Mass Name	Winter Fraction	Summer Fraction
1 Wdw Front(N)	SSSlb	0.30	0.30

- *Fenestration #/Type/Orien.* The fenestration surface which transmits solar gain to an interior unconditioned space thermal mass. This corresponds to an item in the fenestration surfaces table.
- *Mass Name.* The name of the mass element to which solar gains are directed. The mass name corresponds to an item in the thermal mass table.
- *Winter Fraction.* The fraction of solar gains targeted from the glazing surface to the absorbing thermal mass when the building is in a heating mode.
- *Summer Fraction.* The fraction of solar gains targeted from the glazing surface to the absorbing thermal mass when the building is in a cooling mode.

Overhangs. Overhangs are a minimum ACM capability and are described in this table.

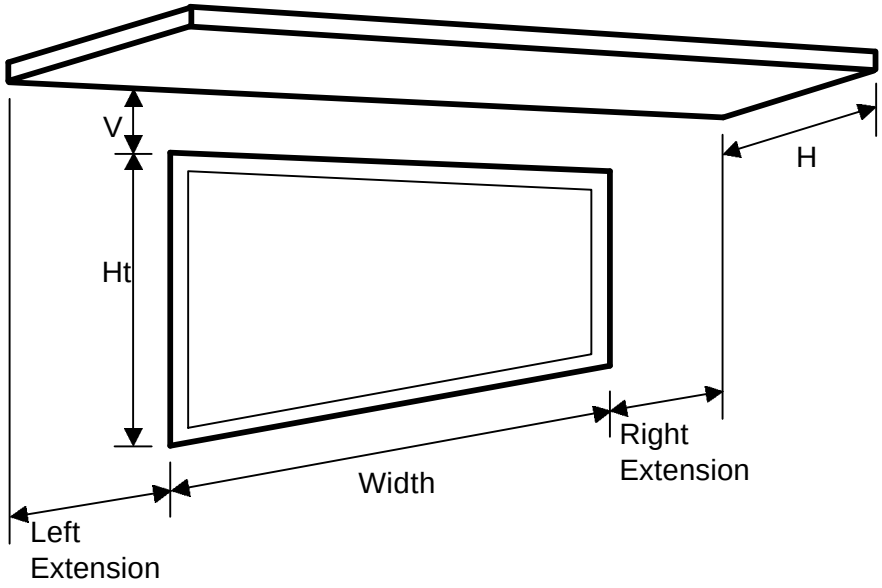

Figure 2-1 - Overhang Dimensions

OVERHANGS

Fenestration			Overhang			
#/Type/Orien	Wdth	Ht	Lngth "H"	Ht "V"	Left Extension	Right Extension
3 Wdw Back(S)	4.0	5.0	2.6	1.5	6.0	6.0

- *Fenestration #/Type/Orien.* This corresponds to an item in the fenestration surfaces list.
- *Fenestration Wdth.* The width of the rough-out frame opening for the fenestration (in feet) measured from the edge of the opening on one side to the edge of the opening on the other side.
- *Fenestration Ht.* The height of the rough-out frame opening for the fenestration (in feet) measured from the bottom of the opening or frame to the top of the opening or frame.
- *Overhang Lngth "H".* The horizontal distance in feet from the surface of the glazing to the outside edge of the overhang.
- *Overhang Ht "V".* The vertical distance (in feet) from the top of the glazing frame to the bottom edge of the overhang at the distance “H” from the glazing surface. See Figure 2-1.
- *Overhang Left Extension.* The distance in feet from the left edge of the glazing frame to the left edge of the overhang. "Left" and "right" are established from an exterior view of the window.
- *Overhang Right Extension.* The distance in feet from the right edge of the glazing frame to the right edge of the overhang.

Side Fins. Side fins are an optional capability. If an ACM does not provide this option, then this table is not used.

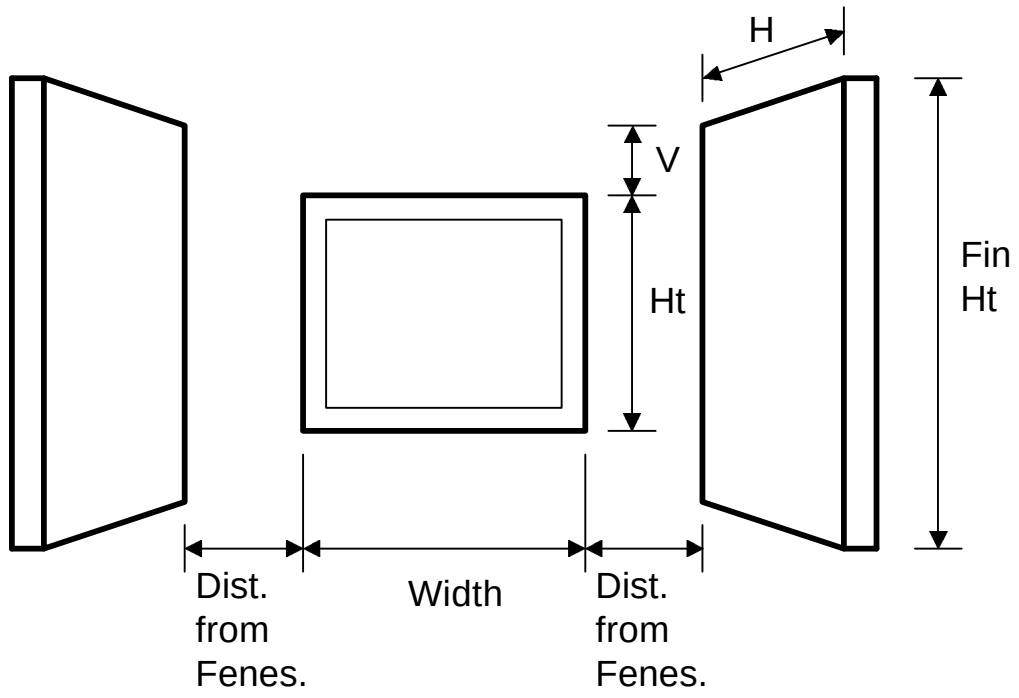

Figure 2-2 - Side Fin Dimensions

SIDE FINS

Fenestration			Left Fin				Right Fin			
#/Type/Orien	Wdth	Ht	Dist from fenes	Lngth "H"	Ht "V"	Fin Ht	Dist from fenes	Lngth "H"	Ht "V"	Fin Ht
3 Wdw Back(S)	4.0	5.0	6.0	2.0	6.0	8.0	6.0	2.0	6.0	8.0

- *Fenestration #/Type/Orien.* This must correspond to an item in the fenestration surfaces list.
- *Fenestration Wdth.* The width of the rough-out opening for the fenestration (in feet) measured from the edge of the opening or frame on one side to the edge of the opening or frame on the other side.
- *Fenestration Ht.* The height of the rough-out opening for the fenestration (in feet) measured from the bottom of the opening or frame to the top of the opening or frame.
- *Left Fin Dist from fenes*. The distance in feet from the nearest glazing frame edge to the fin. "Left" and "right" are established from an exterior view of the window.
- *Left Fin Lngth "H".* The horizontal distance in feet from the surface of the glazing to the outside edge of the fin..

- *Left Fin Ht "V".* The vertical distance (in feet) from the top of the glazing frame to the top edge of the fin.
- *Left Fin, Fin Ht.* The height of the fin, in feet.
- *Right Fin.* Similar to Left Fin items.

Inter-Zone Surfaces. This listing is used only for proposed designs modeled as multiple thermal zones which is considered an exceptional condition and must also be listed in the *Special Features and Modeling Assumptions* listings for the CF-1R and the C-2R. The *Special Features and Modeling Assumptions* listing must direct plan and field checkers to the listings for *Interzone Surfaces* and *Interzone Ventilation*. The *Interzone Surfaces* listing describes the characteristics of the surfaces that separate the zones.

For buildings that are modeled with more than two thermal zones, the inter-zone surfaces shall be grouped so that it is clear which zones are separated by the surfaces. The groupings shall be labeled "Between ZoneName1 and ZoneName2" or some similar convention.

INTER-ZONE SURFACES

Surface Type	Area (ft^2)	U-value	Cavity Insul R-val	Sheath Insul R-valu	Form 3 Reference	Location/Comments
Between Living and Sunspc						
Wall	100	0.09	R-11	na	Wall-2	Insulated partition
Glass	30	1.10	SglGls	na		Sliding glass door
Between Sleeping and Sunspc						
Wall	220	0.09	R-11	R-4	Wall-2	Insulated partition
Glass	10	1.10	SglGls	na		Window
Between Living and Sleeping						
Wall	206	0.293	R-0	na	Wall-3	Gypsum partitions
Door	40	0.33	R-0	na		Hollow core doors

- *Surface Type.* The type of surface separating the zones. Possible types are window, wall, etc.
- *Area (ft^2).* The area of the surface in square feet that separates the zones.
- *U-val.* The U-value of the surface.
- *Cavity Insul R-val.* The R-value of insulation installed in cavity of the framed construction assembly. This does not account for framing effects, drywall, air films, etc.
- *Sheath Insul R-val.* The total R-value of all insulation layers (layers R-2 or greater) not penetrated by framing. Excludes low R-value layers such as sheetrock , building paper, and air films.
- *Form 3 Reference.* A reference to attached Form 3's that may accompany the compliance documentation.

- *Location/Comments.* User provided information on the location of the inter-zone surface or other relevant information.

Inter-Zone Ventilation. This listing is used for proposed designs that are modeled as multiple building zones. The modeling of multiple building zones is considered an exceptional condition that must be reported in the *Special Features* and *Modeling Assumptions* listings which must also refer to the information in this listing when this listing is generated by the ACM to echo user inputs for Inter-Zone Ventilation. If inter-zone ventilation is modeled, it must be reported in this listing It describes natural and/or mechanical ventilation systems that separate the zones.

For buildings that are modeled with more than two thermal zones, the inter-zone ventilation items shall be grouped so that it is clear which zones are linked by the items. The groupings shall be labeled "Between ZoneName1 and ZoneName2" or some similar convention.

INTER-ZONE VENTILATION

Vent Type	Inlet Area	Outlet Area	Height Diff.	Fan Watts	Fan Flow (cfm)	Location/ Comments
Between Living and Sunspc						
Natural	20	20	3	na	na	

- *Vent Type.* Possible types are natural and fan.
- *Inlet Area.* The area of the air inlet in square feet. This is used only when vent type is "natural".
- *Outlet Area.* The area of the air outlet in square feet. This is used only when vent type is "natural".
- *Height Diff.* The elevation difference between the inlet and the outlet in feet. This is used only when vent type is "natural". Default is two feet.
- *Fan Watts.* The fan power rating in watts. This is used only for sunspaces and only then when vent type is "fan". Fan energy may be reported as a separate line item or added to the source energy for heating.
- *Fan Flow (cfm).* The cubic feet per minute of air flow provided when the fan is operating. This is used only for sunspaces and then only when vent type is "fan".
- *Location/Comments*. User provided text describing where the item is located or other relevant information.

Thermal Mass for High Mass Design. This listing can only appear if and when the Proposed Design's thermal mass exceeds the required mass threshold. Exceeding this mass threshold and modeling this mass in the Proposed Design is also considered to be an exceptional condition and must be reported in the *Special Features and Modeling Assumptions* listings on the CF-1R and the C-2R. This listing shall provide detail about the thermal mass elements in the building. One row is provided in the table for each mass element.

Thermal mass elements may be located within a single zone, they may separate zones or they may be located on an exterior wall. Mass elements in each of these categories shall be grouped and labeled accordingly.

THERMAL MASS FOR HIGH MASS DESIGN

Mass Name	Area (ft^2)	Thickness (inches)	Volumetric Heat Capacity (Btu/ft^3-°F)	Conductivity (Btu-in)/($hr-ft^2$-°F)	Form 3 Reference	Inside Surface R-value ($hr-ft^2$-°F)/Btu	Location/Comments
Zone=Living							
ExpSlb-L	273	3.5	28	.98	na	0	Exposed in living
CarSlb-L	419	3.5	28	.98	na	2	Carpeted in living
Zone=Sleep							
ExpSlb-S	273	3.5	28	.98	na	0	Exposed in sleeping
CarSlb-S	419	3.5	28	.98	na	2	Carpeted in sleeping
Zone=SunSpc							
SSSlb	450	3.5	28	.98	na	0	Sunspace slab
Between Sunspc and Living							
SSWall	100	8.0	28	.98	na	0	Masonry wall

- *Mass Name.* The name of the mass element. This name may be referenced from the optional solar gains targeting section of the fenestration surfaces table.
- *Area (ft^2).* The area of the mass in square feet.
- *Thickness.* The mass thickness in inches.
- *Heat Capacity.* The volumetric heat capacity of the mass material in Btu/F-cf.
- *Conductivity*. The conductivity of the mass material in Btu-in/hr-ft^2-°F.
- *Form 3 Reference.* A reference to a wall Form 3. This may be used when a mass element is part of an exterior wall to describe an exterior mass wall or the link between a mass material and an opaque wall surface. The mass area should be the same as the sum of the wall surface areas that reference it.
- *Inside Surface R-value.* The thermal resistance of any material (such as carpet or tapestry) that may exist on the inside surface of the thermal mass excluding air films. For instance, if a mass element is carpeted, a surface R-value of 2 is the fixed input. For mass elements that separate thermal zones, the surface R-value may be reported separately for each side of the mass.
- *Location/Comments.* User provided information on the location of the mass element or other relevant information.

HVAC Systems. Information is provided on the type of heating and cooling systems proposed for each zone of the building. Data in the table is organized to accommodate any type of heating or cooling system so some of the information is not applicable for all

system types. When the information is not applicable, "na" is reported. Data in this table should be organized first by heating and cooling system. Note that the thermostat type is reported under "Building Zone Information" described above.

For buildings that are modeled as multiple thermal zones, the items shall be grouped for each zone and indicated with a header "Zone = <ZoneName>". The zone name used in the header should be the same as the name used in the table titled "Building Zone Information"

HVAC SYSTEMS

Equipment Type	Minimum Equipment Efficiency (or Water Heating System Name)[5]	Distribution Type and Location	Duct R-value
Zone=Living			
Furnace	0.78 AFUE	DuctsCrawl	4.2
AirCond-Split	10.0 SEER	DuctsCrawl	4.2
Zone=Sleep			
CombHydro	Upper Floors	Baseboard	na.
AirCond-Split	10.0 SEER	DuctsAttic	4.2

- *Equipment Type.* The type of heating or cooling equipment. This is specified separate from the distribution type. Required heating equipment and cooling equipment entries are listed in Table 2-7. When the proposed house is not air conditioned, the entry should be NoCooling. If more than one type of equipment is specified, they may be listed on subsequent rows.

[5] "Water Heating System Name" may be omitted from heading, except when combined hydronic systems are used.

Table 2-8 - HVAC Equipment Types

	Heating Equipment
Furnace	Can be gas, oil or propane; central or wall unit. Distribution systems can be gravity, or any of the ducted systems.
Boiler	Can be gas, oil or propane. Distribution systems can be any of the defined systems. "Boiler" is specified for dedicated hydronic systems.
HtPumpSplit	Distribution system must be one of the ducted systems
HtPumpPckg	Distribution system must be one of the ducted systems
Electric	Includes all electric heating systems other than HtPumpSplit or HtPumpPckg, for instance, electric resistance, electric boilers or hot water heat pumps. Distribution systems can be Radiant, Baseboards or any of the ducted systems
CombHydro	Heating system can be storage gas, storage electric or heat pump water heaters. Distribution systems can be fan, radiant or any of the ducted systems.
	Cooling Equipment
No cooling	Entered when the proposed building is not air conditioned
AirCondSplit	Distribution system must be one of the ducted systems
AirCondPackg	Distribution system must be one of the ducted systems
HtPumpSplit	Distribution system must be one of the ducted systems
HtPumpPackg	Distribution system must be one of the ducted systems

- *Minimum Equipment Efficiency.* The minimum equipment efficiency needed for compliance. The applicable efficiency units should also be reported, for instance AFUE for furnaces and boilers, HSPF for electric heating equipment, and SEER for heat pumps (cooling) and central air conditioners. In the case of combined hydronic heating, the name of the water heating system should be identified. If equipment type is Electric, an HSPF of 3.413 should be entered, except for radiant systems which use a maximum HSPF of 3.55.

- *Distribution Type and Location.* The choices for distribution type and location are shown in Table 2-10 with a brief discussion of each. Any duct location other than all ducts in the attic (*DuctsAttic)* must also be reported in the *Special Features and Modeling Assumptions* listings AND the *HERS Required Verification* listings on the CF-1R and C-2R forms printed by the ACM.

Table 2-9 - Heating and Cooling Distribution Types and Locations

	Distribution System Type/Location
DuctsAttic DuctsCrawl DuctsGarage DuctsBasemt DuctsCVC DuctsInEx12 DuctsInAll	The fan powered ducted distribution systems can be used with any of the heating and cooling systems. When ducted systems are used with furnaces or boilers, then the electricity used by the fan shall be calculated using the methods described later in this manual. If a ducted distribution system is indicated, then the R-value must be indicated in the next column. "DuctsInEx12" is used for ducted distribution systems where all the main air handler and all but 12 lineal feet or less of ducts and plenums are within conditioned space such as an HVAC unit in a garage adjacent to the conditioned space. For the purpose of determining duct and plenum lengths, the "length" of a plenum return box is the cross diagonal of the box. "DuctsInAll" must have both the HVAC unit and any ducts or plenums located totally within conditioned space. "DuctsInAll" is also used for non ducted fan systems, such as a wall furnace with fan.
DuctLess	This distribution system is most typical for a wall furnace with no fan and floor furnaces, although some central systems might also be constructed without ducts (distributed fan coil units).
Radiant	A ductless system that can be used with a boiler, electric or combined hydronic heating equipment (with no fan).
Baseboard	A ductless system that can be used with a boiler, electric or combined hydronic heating equipment (with no fan).

The default distribution type and location is a ducted, central system with 100% of the ducts in the attic. If a duct design is specified with duct locations on the plans but without specific duct surface areas (sizes and lengths) specified, a *Special Features and Modeling Assumptions* entry which specifies the default duct locations that are specified in Section 3.8.3. To use DuctsCrawl or DuctsBsmt, all supply registers must be in the floor and the *Special Features and Modeling Assumptions* listings must indicate that all supply registers are in the floor.

- *Duct R-value.* The installed R-value for duct insulation. The minimum duct insulation is 4.2 which is required by the mandatory measures section.

Special Systems - Hydronic Distribution Systems and Terminals. This listing must be completed for hydronic systems that have more than 10 feet of piping (plan view) located in unconditioned space. As many rows as necessary may be used to describe the piping system. Note that hydronic heating systems (combined or not) must be reported in the *Special Features and Modeling Assumptions* listings. The entry for the *Special Features and Modeling Assumptions* listings must indicate any additional listings that are reported for this feature so that the local enforcement agency can verify the additional information needed to check this special feature.

SPECIAL SYSTEMS - HYDRONIC DISTRIBUTION SYSTEMS AND TERMINALS

Distribution System Name	Terminal Type	Number (#)	Piping Run Length (ft)	Nominal Pipe Size (in)	Insulation Thickness (in)	Insulation R-value
HydFanCoil	FanCoil	1	15	1.5	1.5	6.0
	Baseboard	1	20	,75	1	4.0
	FanCoil	1	15	.5	1.5	4.0

- *System Name (text):* Description given to the hydronic system.
- *Terminal Type (prescribed descriptor):* The type of terminal equipment used in the system.

  Permissible types: Listed in Table 2-11.

Table 2-10 Hydronic Terminal Descriptors

Descriptor	Hydronic Terminal Reference
FanCoil	Ducted fan coil used in central systems
Baseboard	Baseboard convector using natural convection
RadiantFlr	Radiant floor

- *Piping Run Length (ft).* The length (plan view) of distribution pipe located in unconditioned space, in feet, between the primary heating/cooling source and the point of distribution.
- Nominal *Pipe Size.* The nominal (as opposed to true) pipe diameter in inches.
- *Insulation Thickness (in).* The thickness of the insulation in inches. Enter "none" if the pipe is uninsulated.
- *Insulation R-value (hr-ft^2-°F/Btu).* The installed R-value of the pipe insulation. Minimum pipe insulation for hydronic systems is R-4 for 2" or smaller pipe, and R-6 for pipe diameter larger than 2".

Water Heating Systems. This listing includes information about water heating systems. A water heating system may serve more than one dwelling unit. A system may also have more than one water heater, but may have only one distribution system. Each water heating system in the building is defined in one or more rows in the following table. Data in this table is associated with data in the Water Heating System Credits Table, the Water Heater Equipment Detail Table, and the Water Heating System Assignments Table. When there are multiple water heater types in a system, the last six columns may be repeated as necessary.

WATER HEATING SYSTEMS

System Name	Distribution Type	Water Heater Name	Water Heater Type	Number in System	Energy Factor	Tank Size (gal)
Upper Floors	Recirc/Timer	State100	SG	3	.52	100
		State67	SG	3	.55	67
Lower Floors	Recirc/Timer	State50	SG	4	.62	50
Kitchens	POU	Loch006	IE	18	.98	na.

- *System Name.* This is a user defined name for the water heating system that provides a link between the water heating systems table, the Water Heating Systems Credits Table, and the Water Heater System Assignments Table.
- *Distribution Type.* Several specific distribution systems are recognized. The distribution system will be one of the following choices. Qualifying requirements for these distribution systems are included in Section 6.6 of the *Residential Manual*.

Table 2-11 - Water Heating Distribution Types

Standard	RecrcDmd (recirculation with demand control)
PtOfUse (point of use),	RecrcTmp (recirculation with temperature control)
HtWtrRcv (hot water recovery),	R/D&HWR (recirc/demand & hot water recovery)
PipeInsl (pipe insulation)	R/D&PIns (recirc/demand & pipe insulation)
RecrcNC (recirculation with no controls)	RecrcT&T (recirc with timer and temp controls)
RecrcTim (recirculation with timer control)	PrllPipe (parallel piping)

- *Water Heater Name.* This is a user defined name that provides a link between the Water Heater System Table and the Water Heater Equipment Detail Table.
- *Water Heater Type.* The water heater type will be one of the following choices. The large storage gas water heaters are larger than the 75,000 Btu/h maximum input rated by the National Appliance Energy Conservation Act (NAECA). Indirect gas water heaters are essentially a boiler with a separate storage tank. Additional data required for large storage gas and indirect gas types is entered later in the Water Heater Equipment Detail table. "Gas" is used for propane as well as natural gas. If oil water heaters are used, the "gas" choices may be selected.

Table 2-12 - Water Heater Types

SG (storage gas)	IG (instantaneous gas)
SO(storage oil)	IE (instantaneous electric)
SE (storage electric)	LgG (large storage gas)
HP (heat pump water heater)	IndG (indirect gas)

- *Number in System.* The number of identical water heaters that exist in the system.

- *Energy Factor*. The energy factor is the principal performance factor for water heater types subject to NAECA regulations, including storage gas, storage electric, instantaneous electric and heat pump water heaters. If the energy factor is not published, this means that the water heater is not covered by NAECA and the Water Heater Equipment Detail Table must be completed.
- *Tank Size (gal).* The storage tank capacity in gallons. This input is applicable to all storage type water heaters.
- Note: External Insulation Wrap is no longer allowed as a modeling option for approved ACMs.

Special Water Heating System Credits. This section includes information about water heating auxiliary energy credits, if used. These features are optional capabilities for ACMs and their use for performance compliance requires listing in the *Special Features and Modeling Assumptions* listings of the CF-1R and the C-2R. The *Special Features and Modeling Assumptions* listing must cross-reference the listing below which must be included as part of the C-2R when any of these applicable optional water heating capabilities are modeled by the ACM.

SPECIAL WATER HEATING SYSTEM CREDITS

System Name	Solar Savings Fraction	Pump Energy (Y/N)	Wood Stove Boiler? (Y/N)	Wood Stove Boiler Pump? (Y/N)
Upper Floors	.60	Y	na.	na.

- *System Name.* This is a name corresponding to a system name defined in the water heating systems table.
- *Solar Savings Fraction*. If the water heating system has a solar system to provide auxiliary heating, the solar savings fraction is entered in this column. The solar savings fraction may be determined using f-Chart or other methods approved by the CEC. A system may have solar auxiliary or a wood stove boiler, but not both.
- *Pump Energy (Y/N).* This is a yes/no response to indicate whether or not pump energy should be considered in the ACM calculation. "No" should be entered if the solar system does not have a recirculation pump or if the energy of the pump was already included in the supporting f-Chart analysis. "Yes" is entered only if the system has a pump and it was <u>not</u> considered in the f-Chart analysis. Active solar systems generally have a pump, while thermosyphon and integral collector storage (ICS) systems generally do not.
- *Wood Stove Boiler (Y/N).* This is a yes/no response on whether or not the system has a wood stove boiler. A credit may be taken for either solar systems or for a wood stove boiler, but not both.
- *Wood Stove Boiler Pump (Y/N).* This is a yes/no response to indicate whether the wood stove boiler has a recirculation pump.

Special Water Heater/Boiler Details. This listing describes the equipment that serves the water heating system or systems. It is only necessary to complete this table for combined hydronic systems and for non-NAECA water heaters. The information in the table will not be applicable to every water heater type. The use of these features for performance compliance requires listing in the *Special Features and Modeling Assumptions* listings of the CF-1R and the C-2R. The *Special Features and Modeling Assumptions* listing must cross-reference the listing below which must be included as part of the C-2R when any of these Special Water Heating Equipment characteristics are modeled by the ACM. When the information is not applicable, "na" may be reported.

SPECIAL WATER HEATER /BOILER DETAILS

Water Heater Name	Recovery Efficiency (fraction)	AFUE (fraction)	Rated Input (kBtuh)	Combined Hydronic Pump (watts)	Standby Loss (fraction)	Tank Total R-value (hr-ft^2-°F/Btu)	Pilot Light (Btu/h)
Loch006	na.	0.78	na.		na.	na.	na.
State100 Hydro	na.	0.79	40	40	na.	na.	na.
State50	na.	0.80	na.		na.	na.	na.

- *Water Heater Name.* This is a user defined name that provides a link to the water heater system table. In the case of a hydronic system heater, the name should be descriptive of this function to distinguish it from any domestic water system heaters.
- *Recovery Efficiency (fraction).* Recovery efficiency is the performance measure for instantaneous gas water heaters, large storage gas water heaters and indirect gas water heaters. It is also needed for storage gas water heaters used in combined hydronic systems. The value is taken from the CEC Appliance Database[6]or from manufacturers literature. If the value is omitted for NAECA regulated water heaters, then the default value will be assumed.
- *AFUE (fraction).* The Annual Fuel Utilization Efficiency, the heating efficiency of the water heater based upon approved test methodologies. Values of AFUE are listed in the Commission Appliance Database.
- *Rated Input (kBtu/h).* The energy input, in kBtu/h (thousands of Btus per hour), from the CEC Appliance Database or from manufacturers literature. This is needed for large storage gas and indirect gas water heaters and when storage gas water heaters or heat pump water heaters are used for combined hydronic space heating.
- *Combined Hydronic Pump (watts).* This is needed only for electric combined hydronic systems. It is not needed for storage gas or heat pump combined hydronic systems.

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[6] See Footnote 3, Page 2-22.

- *Standby Loss (fraction).* The standby loss percent per hour (taken from the CEC Appliance Database or from manufacturers literature) divided by 100. Applicable to large storage gas water heaters only.
- *Tank Total R-value (hr-ft^2-°F/Btus).* The total thermal resistance for both the tank and the insulation. This input is applicable to large storage gas and indirect gas water heaters only.
- *Pilot Light (Btu/h).* The pilot light energy, in Btu/h, from the CEC Appliance Database or from manufacturers literature. This column is only applicable for instantaneous gas water heaters and indirect gas water heaters.

Table 2-14 summarizes the applicability of the inputs for the water heater types recognized by the calculation method.

Table 2-13 - Water Heater Input Summary

Input Item	NAECA Storage Gas	NAECA Storage Electric	NAEC A Heat Pump	Instant. Gas	Instant. Electric	Large Storage Gas	Indirect Gas
Energy Factor	Yes	Yes	Yes	Yes	Yes		
Pilot Input, Btu				Yes		Yes	Yes
Efficiency, %[7]						Yes	Yes
Standby Loss, %						Yes	
Tank Volume, gal.	Yes	Yes	Yes			Yes	Yes
Tank Insulation, R						Yes	Yes
Ext. Insulation, R						Yes	Yes
			If Combined Hydronic System:				
Rated Input, kBtuh	Yes					Yes	Yes
Rated Input, kWI		Yes	Yes				
Recovery Eff, %	Yes		Yes			Yes	Yes
Pump Input, Watts		Yes				Yes	Yes

Special Water Heating System Assignments. In multi-unit buildings or buildings with more than one water heating system, it is necessary to assign water heating systems to the dwelling units that they serve. This is necessary in order for the recovery load to be properly calculated for each system. When an ACM models a water heating system that does not have a single separate water heater serving each dwelling unit, it must be reported in the *Special Features and Modeling Assumptions* listings of the CF-1R and the C-2R. The *Special Features and Modeling Assumptions* listing must cross-reference the listing below which must be included as part of the C-2R whenever multiple water heaters serve

[7] May be recovery efficiency, thermal efficiency, or AFUE.

one or more dwelling units or when a single water heater serves more than one dwelling unit and is modeled by the ACM for compliance.

In the example below, the building has three water heating systems labeled "upper-floors", "lower-floors" and "kitchens". The "upper-floors" and "lower-floors" systems are both central gas water heaters with recirculating distribution systems. The kitchens in each dwelling unit have their own point of use instantaneous electric water heaters (all of which may be grouped together as one system).

SPECIAL WATER HEATING SYSTEM ASSIGNMENTS *(Example Listing)*

Number of Units	CFA per Unit	Name(s) of System(s)
8	1000	Upper Floors Kitchens
10	800	Lower Floors Kitchens

SPECIAL WATER HEATING SYSTEM ASSIGNMENTS *(Example Listing)*

Number of Units	CFA per Unit	Name(s) of System(s)
1	1800	Main

- *Number of Units*. The number of dwelling units served by this system assignment.
- *CFA per Unit*. The average conditioned floor area per dwelling unit in this system assignment.
- *Name(s) of Systems(s)*. The water heating system names associated with this assignment. Names must correspond to system names defined in the Water Heating Systems table.

***Special Features and Modeling Assumptions*.** This listing must **stand out and command the attention** of anyone reviewing this form to emphasize the importance of verifying these Special Features and the aspects of these features that were modeled to achieve compliance or the energy use results reported. This is a free format section for the C-2R report to note any special features about the building that are needed to verify compliance.

SPECIAL FEATURES AND MODELING ASSUMPTIONS: *(Example Listing)*

This house has zonal control and multiple zones,
This house uses a non-NAECA large storage gas water heater . Check the C-2R SPECIAL WATER HEATER/BOILER DETAILS listing for specifications.
This house has an attached sunspace with interzone surfaces, interzone ventilation, and custom solar heat distribution.

HERS Required Verification. Specific features that require diagnostic testing to assure proper installation require field testing and verification by a certified home energy rater under the supervision of a Commission-approved HERS provider, and must be listed in this section. This listing must **stand out and command the attention** of anyone reviewing this form to emphasize the importance of HERS verification of these features and the aspects of these features that were modeled to achieve compliance. or the energy use results reported.

HERS REQUIRED VERIFICATIONS *(Example Listing)*

This house is using an HVAC system with all ducts and the air handler located within the conditioned space. This results in a higher distribution efficiency rating and must be visually confirmed by a certified HERS rater under the supervision of a CEC-approved HERS provider. This verification must be reported on a CF-6R form.
This 1600 square foot house has tight construction with reduced infiltration and a target blower door test range of 586 to 1250 CFM at 50 pascals. The blower door test must be performed using the ASTM *Standard Test Method for Determining Air Leakage Rate by Fan Pressurization*, ASTM E 779-87 (Reapproved 1992).
WARNING: If this house tests below 586 CFM at 50 pascals, the house must either be provided with a ventilation opening that will increase the tested infiltration to at least 586 CFM at 50 pascals (SLA = 1.5) OR mechanical supply ventilation must be provided that can maintain the house at a pressure of at least -5 pascals relative the outside average air pressure while other continuous ventilation fans are operating.
WARNING - Houses modeled with reduced infiltration and/or mechanical unbalanced exhaust ventilation are prohibited from having vented combustion appliances that use indoor air for combustion inside conditioned space.